PRE-PENNSYLVANIAN SURFACE WEST OF THE DUQUOIN ANTICLINE.*

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Introduction.

During some stratigraphic studies on the Pennsylvanian, the results of which are to be included in a general report on the coal of the State, several interesting features of the pre-Pennsylvanian surface west of the Duquoin anticline were discovered. Several profiles, based on well records, were drawn across this region from west to east (one is reproduced in fig. 1). They showed that the contour of the Mississippian-Pennsylvanian unconformity, the depositional structure of the Pottsville and Carbondale formations, and the geographical, lithologic changes within the Pottsville correspond. This correspondence is so significant that the paleogeography of the region in Pottsville and Carbondale times can be determined.

Selection of a Datum Plane.

To eliminate the post-Pennsylvanian deformations, it was necessary to find a datum plane which represents an original, level surface. No. 6 coal was chosen because it is the most easily followed horizon in the Pennsylvanian, it is wide spread, its formation was conditioned by a state of quietude in geologic processes that is unique for the "Coal Measures" of Illinois, and its deposition marked the climax of those geologic processes during the Pottsville and Carbondale which worked toward an extension of the seas and the filling of the basins.

Mississippian-Pennsylvanian Contact.

The contour of the pre-Pennsylvanian surface was delineated by measurements from the datum plane, or No. 6 coal, to the Mississippian-Pennsylvanian contact. Figure 1 is a profile, based on well logs, extending from Millstadt to the Duquoin anticline at Centralia which represents some of these measurements. The vertical scale is 100 feet to the

*Courtesy of the Chief, State Geological Survey.

inch and the horizontal scale is 4 miles to the inch. The straight line at the top is the horizon of No. 6 coal and the bent line at the bottom represents the unconformable contact between the Mississippian and the Pennsylvanian.

The records above the Carbondale and below the Pottsville are omitted.

In figures 1 and 2 the divergence of the lines representing the datum plane and the pre-Pennsylvanian surface is conspicuous. In the vicinity of Millstadt, in St. Clair County, the interval between the top of No. 6 coal and the top of the Mississippian is from 10 feet to about 50 feet. Eastward, to the Clinton County line, the interval increases to about 150 feet, but between this county line and Trenton (Clinton County) the interval increases much more rapidly than elsewhere, i. e. from 150 feet to more than 350 feet. From Trenton eastward to the Duquoin anticline the interval increases less rapidly. Other profiles and well records not exhibited here show that this same general profile of the pre-Pennsylvanian surface is continuous from Madison County south to Coulterville, Randolph County. It is especially interesting that the escarpment near Trenton (figs. 1 and 2) extends almost due south toward Coulterville. It is called the Trenton-Coulterville escarpment in this paper.

Depositional Structure of the Pottsville and Carbondale Formations.

The correspondence between the topography of the pre-Pennsylvanian surface and the depositional structure of the Pottsville and Carbondale formations is significant.

A basin extends eastward from the brink of the Trenton-Coulterville escarpment. Its lowermost portion is filled with Pottsville sediments. The Carbondale formation overlaps the Pottsville and extends westward toward St. Louis; thus filling the rest of the basin below No. 6 coal.

Insofar as specific horizons in the Pottsville can be followed, they appear to thin out westward and to be overlapped by the strata above. If this is true, the thinning out is due more to conditions of deposition than to stages of widespread erosion after deposition, although intraformational unconformities probably are common in the Pottsville. The most that can be said at this time about the

changing thickness of the Carbondale formation is that horizons far apart vertically in the basin converge toward the west. The critical point in determining the causes of this convergence is the correlation of the coal below No. 6 which occurs along the margin of the Carbondale basin at Millstadt and at other places farther north. The correlation of this coal is uncertain, but it is No. 5 coal apparently. In general, then, the thinning of the Pottsville and Carbondale formations westward is due to a series of overlaps which indicates that marine invasions progressed toward the St. Louis region. The greatest overlap is that of the Carbondale over the Pottsville.

Lithologic Differences Within the Pottsville.

The lithology of the Pottsville has considerable bearing in determining the character of the pre-Pennsylvanian surface. Figure 3 is a diagrammatic representation of lithologic changes in the Pottsville formation. In Saline County, quartz pebble conglomerates are restricted to the lower Pottsville, but in western Williamson County and in Jackson County larger quartz pebbles have been found and they are not restricted to the lower Pottsville. The upper Pottsville in Saline County contains at least four marine limestones, and one of these limestones—the Curlew—is rather pure except for the presence of chert, and contains a fauna of large branchiopods, corals, and numerous Fusulinella and other Foraminifera, thus indicating a relatively quiet sea during its formation. In Jackson County, one lenticular limestone is reported from the upper Pottsville; whereas surveys northwest of this place, indicate that no limestones exist in the Pottsville at the outcrops. So the Pottsville takes on a distinct shoreward facies toward the northwest as would be expected from the contour of the pre-Pennsylvanian basin and the consequent depositional structure of the middle and lower Pennsylvanian.

Conclusions.

It appears from the evidence brought out that the pre-Pennsylvanian surface originally consisted of an upland area in the west half and a basin in the east half of this region and that the Trenton-Coulterville escarpment repre-

sents the western margin of the basin. After the filling of this basin by Pottsville sediments the strand line moved westward as a result of a general lowering and extension of the basin, and the Carbondale formation was deposited in the broader basin.

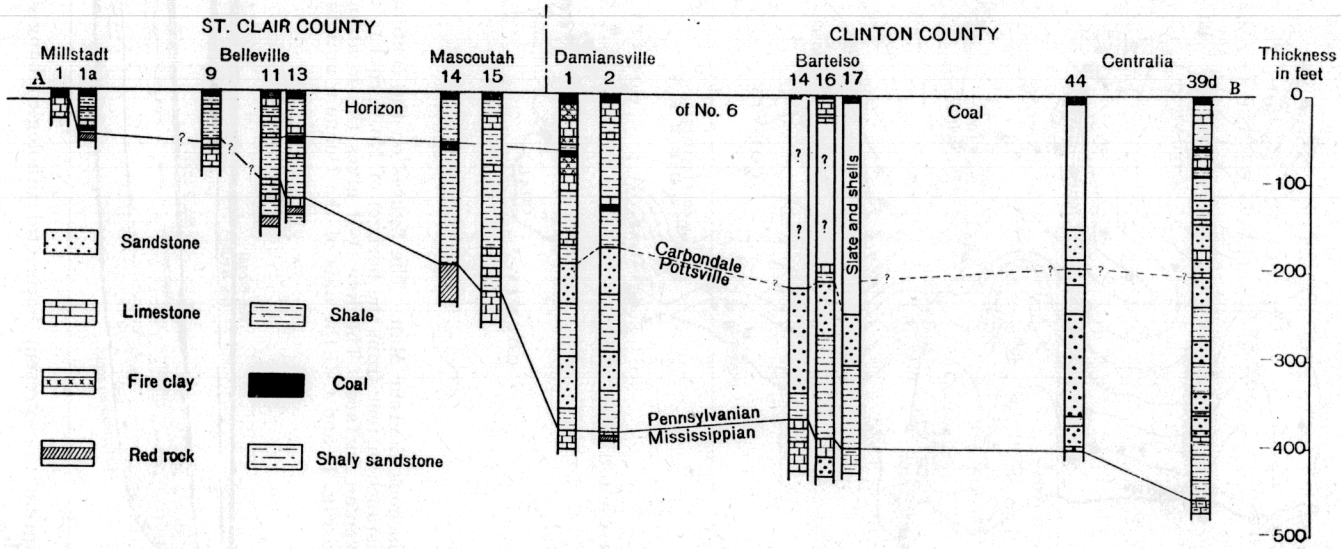

Fig. 1.—Profile showing the thickening of the Carbondale and Pottsville formations eastward. (The numbers at the top of the logs correspond to locations on the isopachous map, Fig. 2).

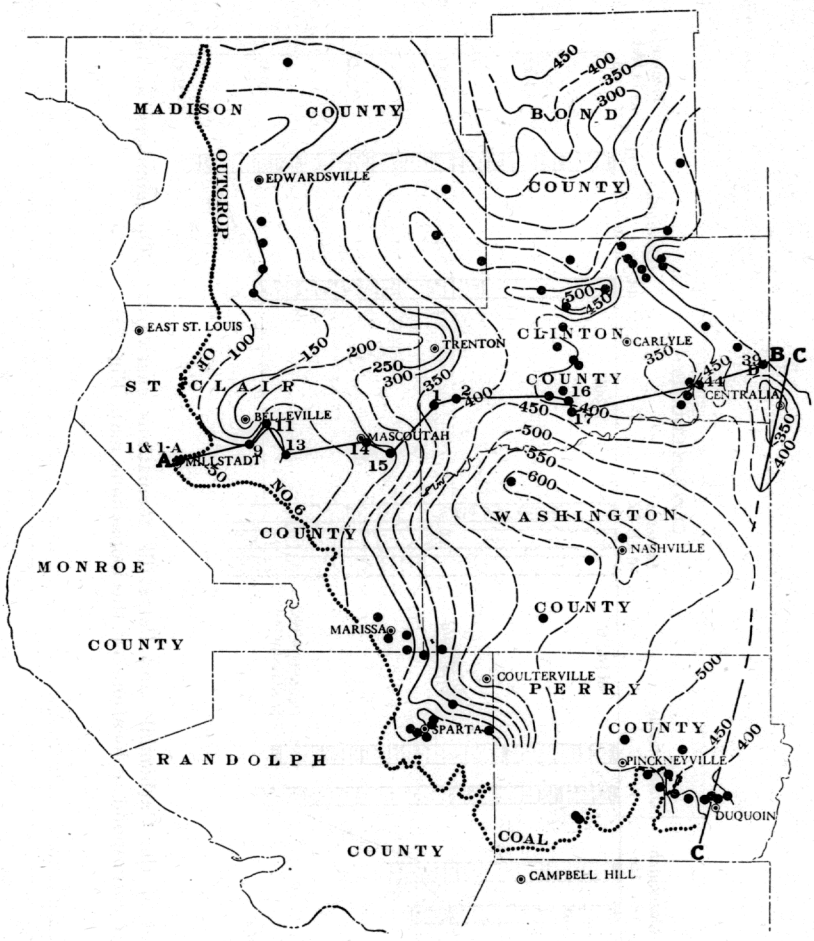

Fig. 2.—Isopachous Contour Map. The figures on the contours refer to the distance in feet from the horizon of No. 6 coal to the pre-Pennsylvanian surface. The line A-B gives the location of the profile in Fig. 1; and C-C the axis of the Duquoin anticline.

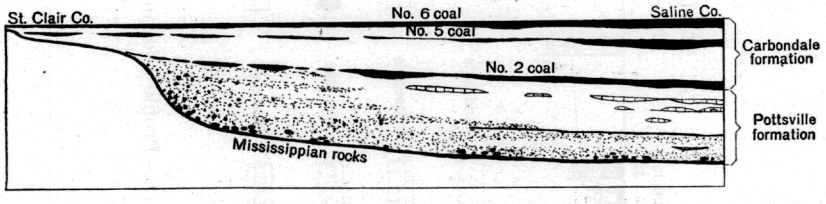

Fig. 3.—Diagram to represent horizontal lithologic changes in the Pottsville.